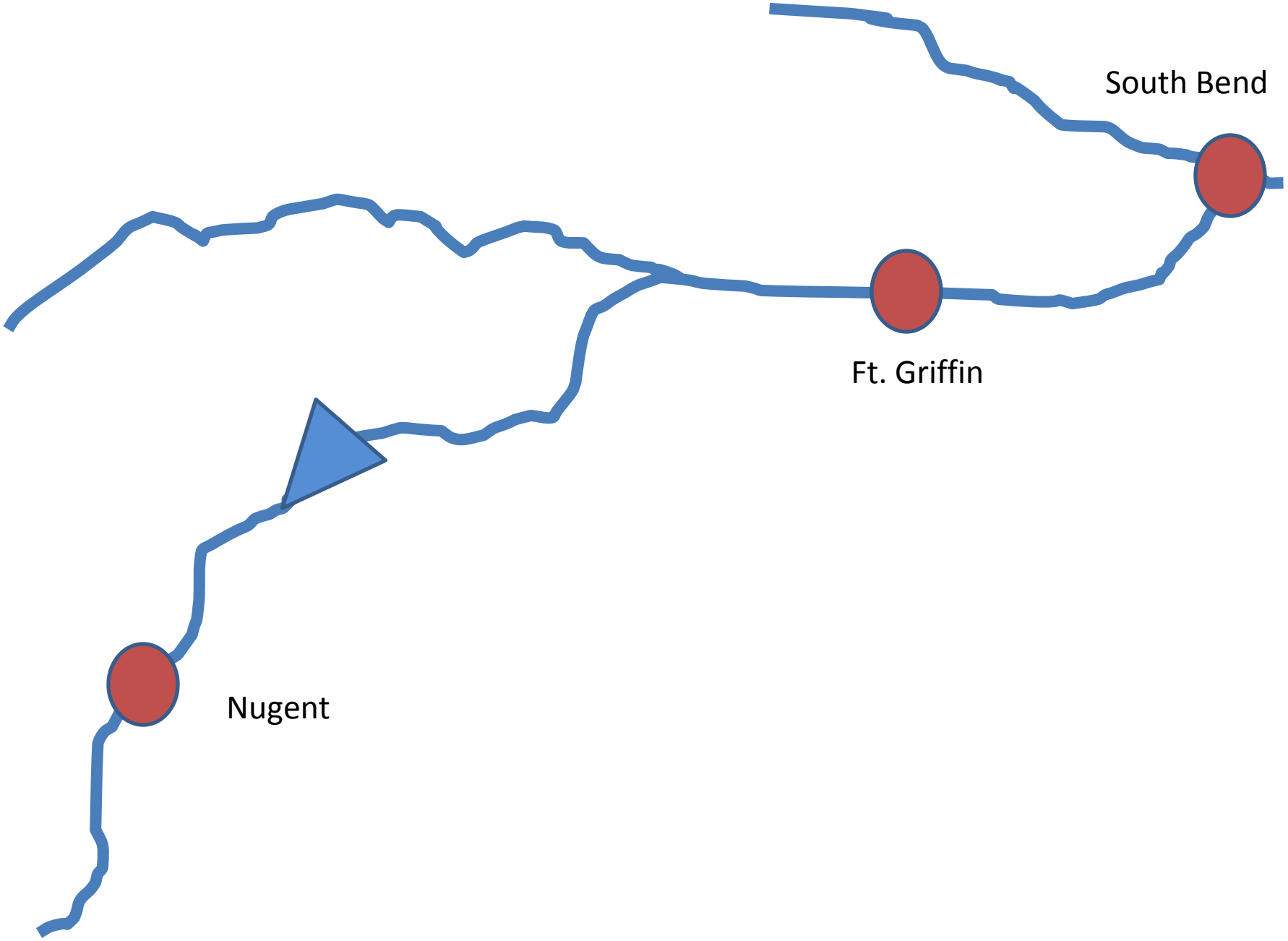
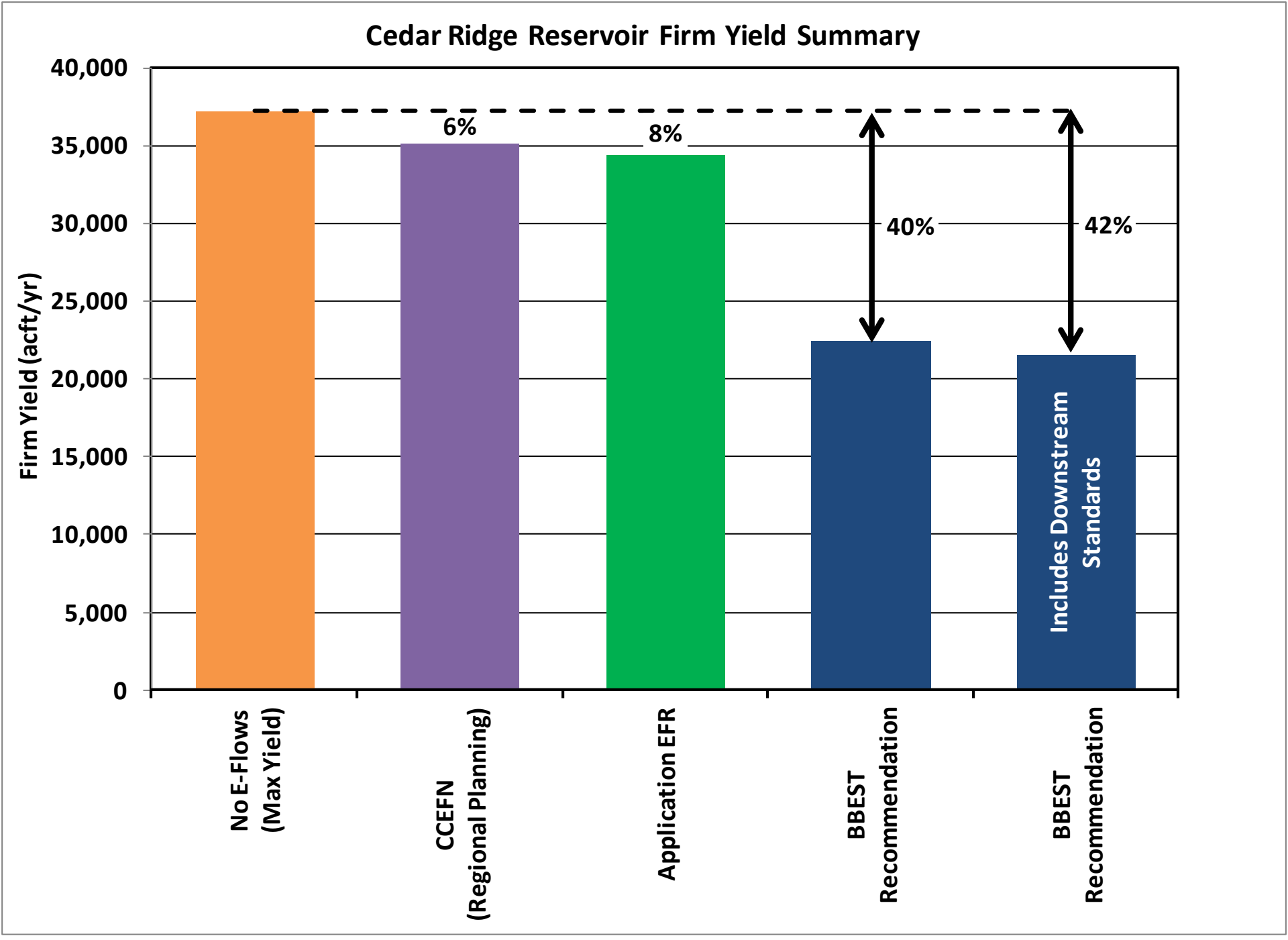
RECOMMENDED EFRs for BBASC Consideration

PRELIMINARY – DRAFT

June 27-28, 2012


South Bend
Ft. Griffin
Nugent


Cedar Ridge Reservoir Firm Yield Summary
Firm Yield (acft/yr)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
6%
8%
40%
42%
Includes Downstream Standards
No E-Flows (Max Yield)
CCEFN (Regional Planning)
Application EFR
BBEST Recommendation
BBEST Recommendation

Clear Fork Brazos River at Cedar Ridge Reservoir Dam - Application

Overbank Events		To be met from spill events from the reservoir, not controlled passes.			
High Flow Pulses	**Wet[1]**	Qp: 50 cfs with Average Frequency 1 per season Regressed Volume is 314 Duration is 5 days	Qp: 384 cfs with Average Frequency 1 per season Regressed Volume is 2,224 Duration is 9 days	Qp: 421 cfs with Average Frequency 1 per season Regressed Volume is 2,157 Duration is 7 days	Qp: 184 cfs with Average Frequency 1 per season Regressed Volume is 843 Duration is 5 days
	Avg[1]	Not Recommended	Qp: 65 cfs with Average Frequency 2 per season Regressed Volume is 311 Duration is 4 days	Qp: 119 cfs with Average Frequency 2 per season Regressed Volume is 501 Duration is 4 days	Qp: 22 cfs with Average Frequency 2 per season Regressed Volume is 77 Duration is 2 days
	Dry[1]	Not Recommended	Qp: 65 cfs with Average Frequency 1 per season Regressed Volume is 311 Duration is 4 days	Qp: 119 cfs with Average Frequency 1 per season Regressed Volume is 501 Duration is 4 days	Qp: 22 cfs with Average Frequency 2 per season Regressed Volume is 77 Duration is 2 days
Base Flows (cfs)	**Wet[1]**	16	14	11	12
	Avg[1]	9	8	6	6
	Dry[1]	5	4	2	2
Subsistence Flows (cfs)[3]		1.5	1.5	1.5	1.5

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Winter				Spring			Summer			Fall	

Notes:

All values shown in cfs and are based on average daily flows and not instantaneous flows. Period of record used: 1/1/1939 to 12/31/2009.

[1]Wet, average and dry hydrologic conditions are determined based on annual demand and reservoir storage on day 1 of each season.

[2]High flow pulses in August are limited to a peak flow of 184 cfs, a volume of 843 acft, and duration of 5 days for juvenile snake considerations (same as the Fall season).

[3]Subsistance flow is equal to the published 7Q2 value for the Clear Fork at Nugent Gage.

Clear Fork Brazos River at Cedar Ridge Reservoir Dam - Recommended for BBASC

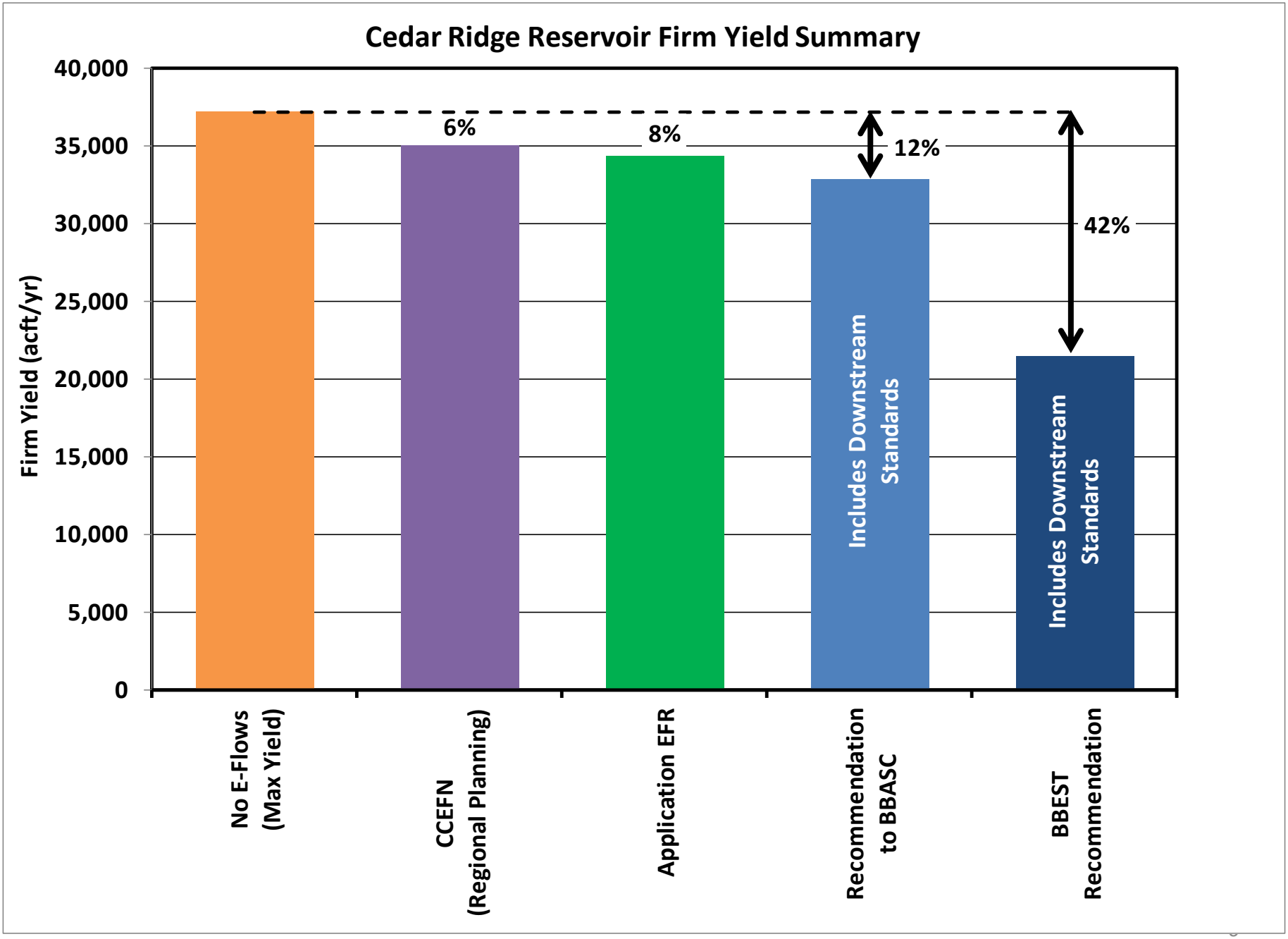
		Winter	Spring	Summer
High Flow Pulses	Wet	Qp: 34 cfs with Average Frequency 1 per season Regressed Volume is 209 Duration Bound is 9	Qp: 771 cfs with Average Frequency 1 per season Regressed Volume is 3,660 Duration Bound is 12	Qp: 510 cfs with Average Frequency 1 per season Regressed Volume is 1,890 Duration Bound is 12
	Avg		Qp: 239 cfs with Average Frequency 2 per season Regressed Volume is 1,124 Duration Bound is 9	Qp: 131 cfs with Average Frequency 2 per season Regressed Volume is 601 Duration Bound is 8
	Dry		Qp: 239 cfs with Average Frequency 1 per season Regressed Volume is 1,124 Duration Bound is 9	Qp: 131 cfs with Average Frequency 1 per season Regressed Volume is 601 Duration Bound is 8
Base Flows (cfs)	Wet	17	16	12
	Avg	11	8	5
	Dry	7	4	1
Subsistence Flows (cfs)		1.0	1.0	1.0

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Winter				Spring				Summer			

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)

Notes:

1. Period of Record used : 1/1/1925 to 12/31/2010.
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 29 cfs and the flow drops from one day to the next by less than 5%.
4. CRR values were calculated by translating BBEST Nugent E-flow criteria downstream to CRR dam site using a drainage area ratio of 1.307.
5. CRR E-flow criteria calculated from DAR with BBEST Nugent E-flow criteria were set to not exceed BBEST Ft. Griffin E-flow criteria.


Cedar Ridge Reservoir Firm Yield Summary
Firm Yield (acft/yr)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
6%
8%
12%
42%
Includes Downstream Standards
Includes Downstream Standards
No E-Flows (Max Yield)
CCEFN (Regional Planning)
Application EFR
Recommendation to BBASC
BBEST Recommendation

Ed Oborny - BioWest

- Effects of Cedar Ridge Application EFR on Ecology of the Clear Fork of the Brazos

Brazos River Stream Gage - Recommendation for BBASC

		Winter	Spring	Summer
High Flow Pulses	Wet	Qp: HFP2 Average Frequency 1 per season Regressed Volume is HFP2 Duration Bound is HFP2	Qp: HFP2 Average Frequency 1 per season Regressed Volume is HFP2 Duration Bound is HFP2	Qp: HFP2 Average Frequency 1 per season Regressed Volume is HFP2 Duration Bound is HFP2
	Avg	Qp:HFP1 cfs with Average Frequency 2 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 2 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 2 per season Regressed Volume is HFP1 Duration Bound is HFP1
	Dry	Qp:HFP1 cfs with Average Frequency 1 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 1 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 1 per season Regressed Volume is HFP1 Duration Bound is HFP1
Base Flows (cfs)	Wet	cfs	cfs	cfs
	Avg	cfs	cfs	cfs
	Dry	cfs	cfs	cfs
Subsistence Flows (cfs)		cfs	cfs	cfs

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Winter				Spring				Summer			

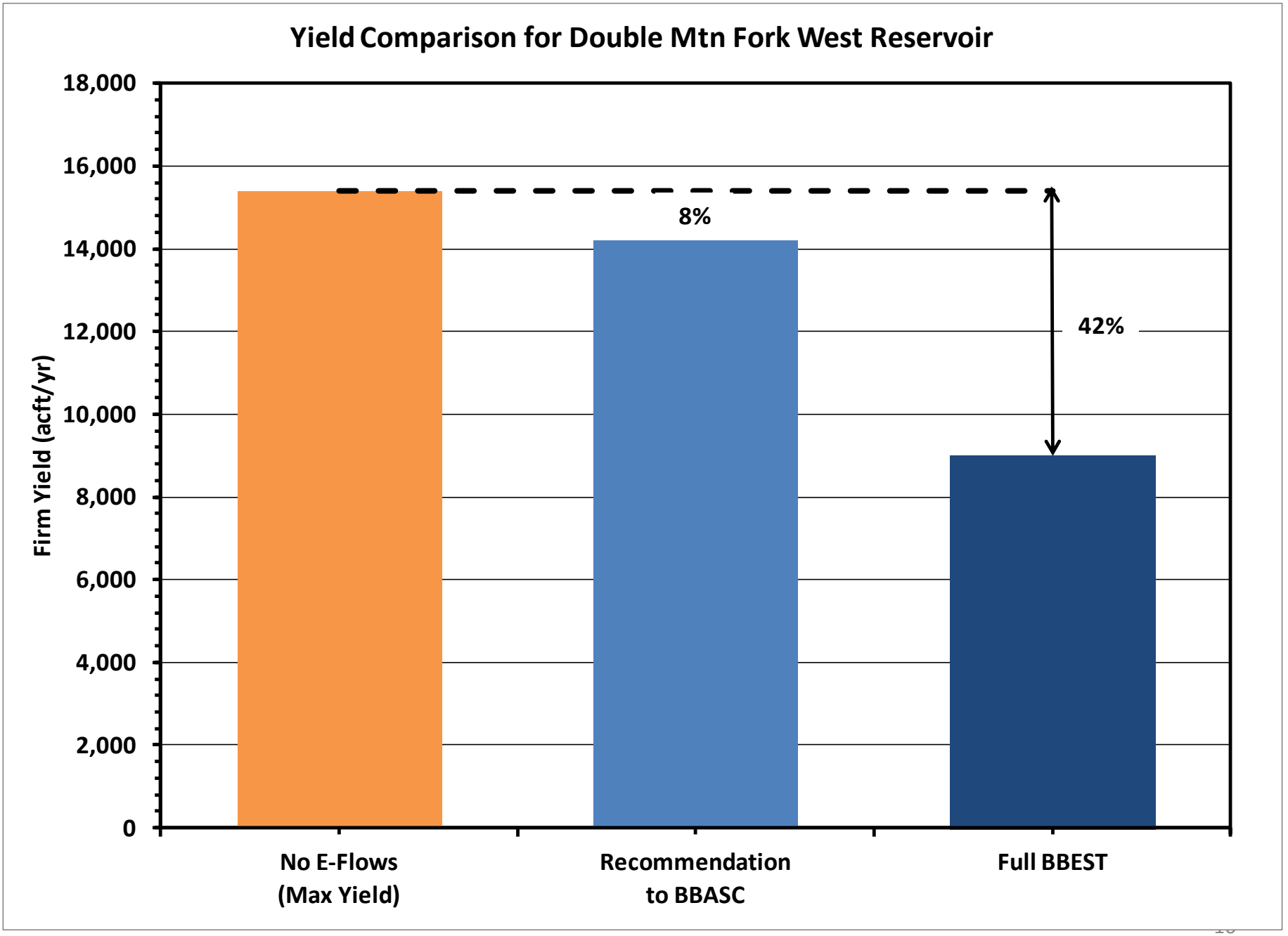
Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)

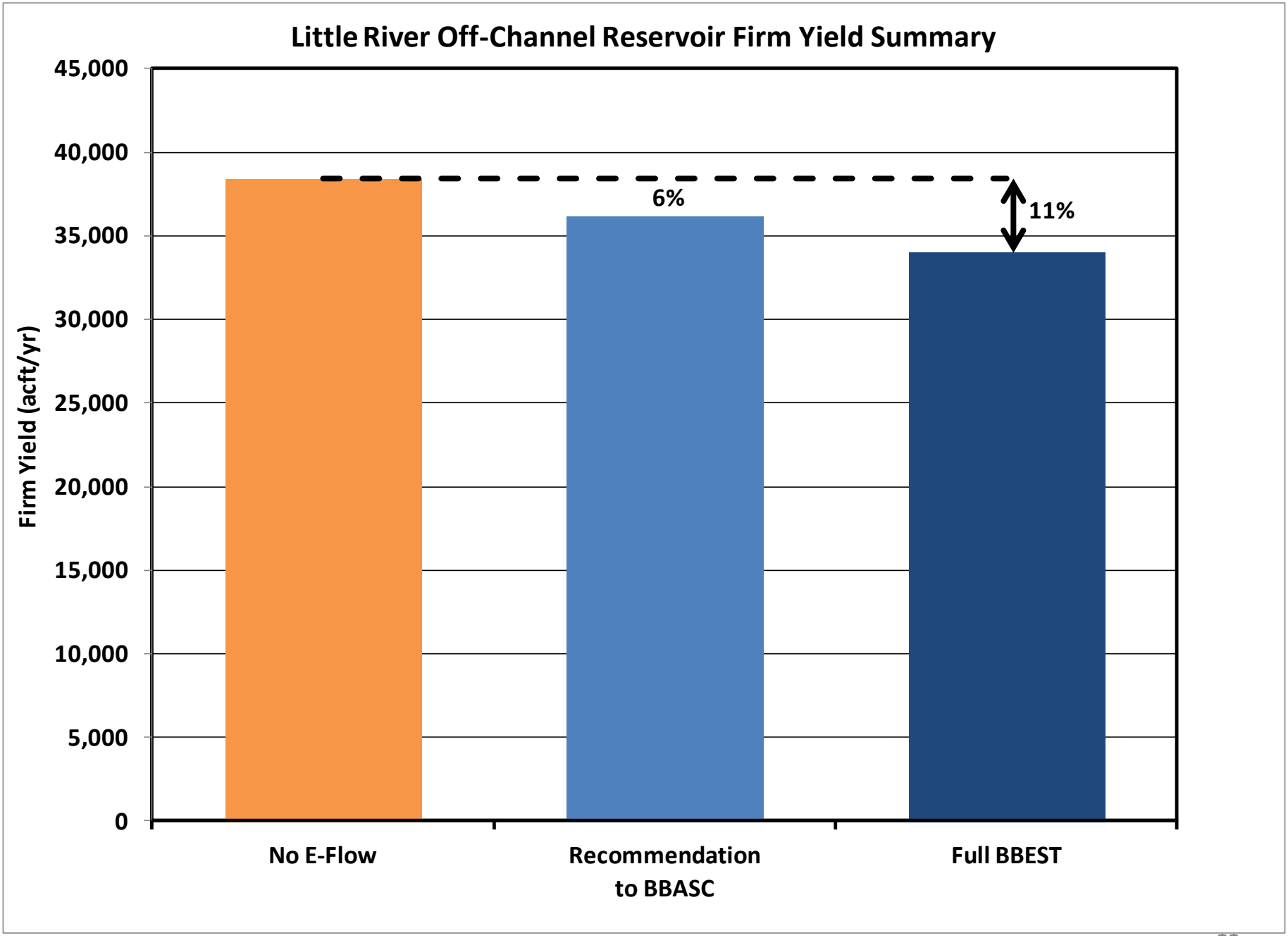
Notes:

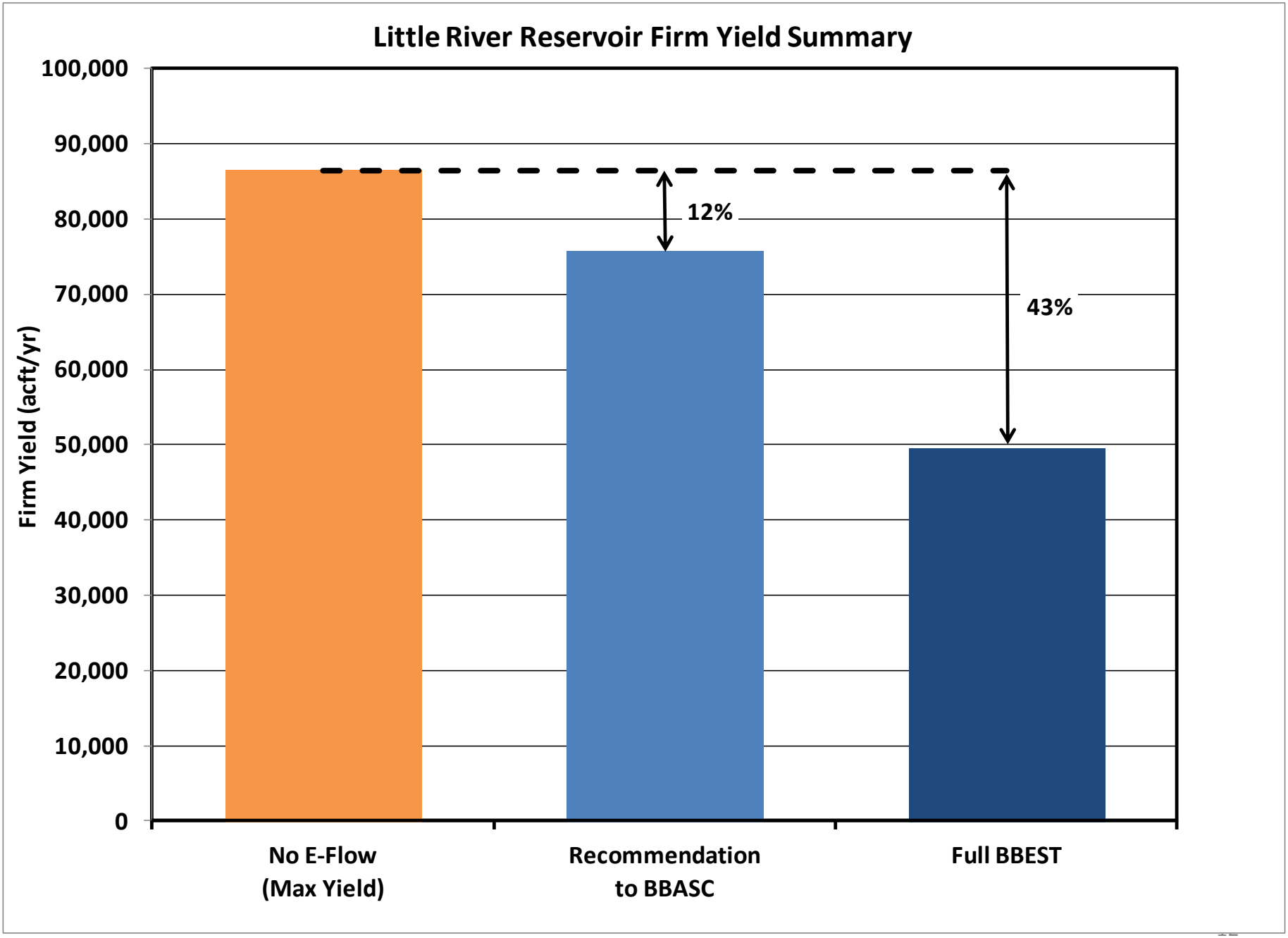
1. Period of Record used : .
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 29 cfs and the flow drops from one day to the next by less than 5%.
4. 50% rule applied as defined by BBASC
5. Wet, Average, Dry defined by hydrologic season.

Impact on Yield

- Evaluated Strategies from Brazos G
  - Double Mountain Fork Reservoir
  - Little River On Channel Reservoir
    - 321,000 acft Storage
    - Unique Reservoir Site
  - Little River Off Channel Reservoir
    - 108” Pipeline (~350 cfs)
    - 155,812 acft Storage
    - Unique Reservoir Site


Yield Comparison for Double Mtn Fork West Reservoir
Firm Yield (acft/yr)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
8%
42%
No E-Flows
(Max Yield)
Recommendation
to BBASC
Full BBEST


Little River Off-Channel Reservoir Firm Yield Summary
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Firm Yield (acft/yr)
6%
11%
No E-Flow
Recommendation to BBASC
Full BBEST


Little River Reservoir Firm Yield Summary
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Firm Yield (acft/yr)
12%
43%
No E-Flow
(Max Yield)
Recommendation
to BBASC
Full BBEST

Brazos River Stream Gage - Recommendation for BBASC

High Flow Pulses	Wet	Qp: HFP2 Average Frequency 1 per season Regressed Volume is HFP2 Duration Bound is HFP2	Qp: HFP2 Average Frequency 1 per season Regressed Volume is HFP2 Duration Bound is HFP2	Qp: HFP2 Average Frequency 1 per season Regressed Volume is HFP2 Duration Bound is HFP2
	Avg	Qp:HFP1 cfs with Average Frequency 2 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 2 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 2 per season Regressed Volume is HFP1 Duration Bound is HFP1
	Dry	Qp:HFP1 cfs with Average Frequency 1 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 1 per season Regressed Volume is HFP1 Duration Bound is HFP1	Qp:HFP1 cfs with Average Frequency 1 per season Regressed Volume is HFP1 Duration Bound is HFP1
Base Flows (cfs)	Wet	cfs	cfs	cfs
	Avg	cfs	cfs	cfs
	Dry	cfs	cfs	cfs
Subsistence Flows (cfs)		cfs	cfs	cfs

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Winter				Spring				Summer			

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)

Notes:

1. Period of Record used : .
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 29 cfs and the flow drops from one day to the next by less than 5%.
4. 50% rule applied as defined by BBASC
5. Wet, Average, Dry defined by hydrologic season.

Questions

Clear Fork Brazos River near Fort Griffin - Full BBEST Recommendation

Overbank Events		Qp: 8,630 cfs with Average Frequency 1 per 2 years Regressed Volume is 53,500 Duration Bound is 27		
High Flow Pulses	**HFP 4**	Qp: 4,970 cfs with Average Frequency 1 per year Regressed Volume is 30,700 Duration Bound is 24		
	HFP 3	Qp: 240 cfs with Average Frequency 1 per season Regressed Volume is 1,740 Duration Bound is 16	Qp: 2,970 cfs with Average Frequency 1 per season Regressed Volume is 17,700 Duration Bound is 18	Qp: 1,980 cfs with Average Frequency 1 per season Regressed Volume is 11,900 Duration Bound is 20
	HFP 2	Qp: 61 cfs with Average Frequency 2 per season Regressed Volume is 430 Duration Bound is 11	Qp: 1,230 cfs with Average Frequency 2 per season Regressed Volume is 7,310 Duration Bound is 15	Qp: 700 cfs with Average Frequency 2 per season Regressed Volume is 4,110 Duration Bound is 16
	HFP 1		Qp: 360 cfs with Average Frequency 4 per season Regressed Volume is 2,120 Duration Bound is 12	Qp: 110 cfs with Average Frequency 4 per season Regressed Volume is 620 Duration Bound is 10
Base Flows (cfs)	**Wet**	34	27	20
	Avg	17	13	5
	Dry	8	5	1
Subsistence Flows (cfs)		1	1	1

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Winter				Spring				Summer			

Flow Levels	**High (75th %ile)**
	Medium (50th %ile)
	Low (25th %ile)

Notes:

1. Period of Record used : 2/1/1924 to 12/31/2010
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 73 cfs and the flow drops from one day to the next by less than 5%.

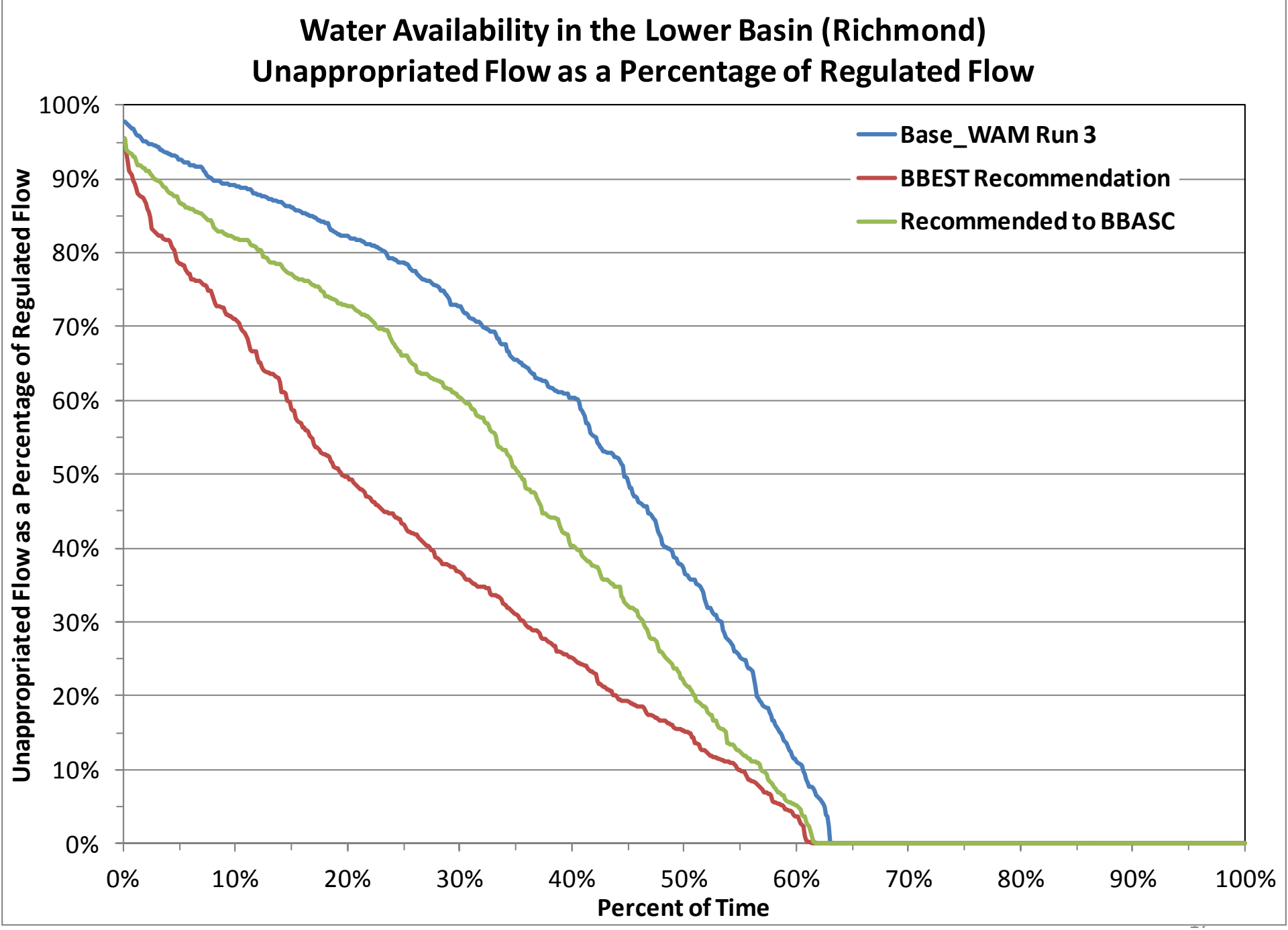
Brazos River near South Bend - Full BBEST Recommendation

		Winter				Spring				Summer			
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Overbank Events		Qp: 25,400 cfs with Average Frequency 1 per 2 years Regressed Volume is 228,000 Duration Bound is 35											
		Qp: 15,800 cfs with Average Frequency 1 per year Regressed Volume is 133,000 Duration Bound is 29											
High Flow Pulses	**HFP 4**	Qp: 960 cfs with Average Frequency 1 per season Regressed Volume is 6,870 Duration Bound is 12				Qp: 9,560 cfs with Average Frequency 1 per season Regressed Volume is 72,100 Duration Bound is 21				Qp: 7,440 cfs with Average Frequency 1 per season Regressed Volume is 57,200 Duration Bound is 23			
	HFP 3	Qp: 280 cfs with Average Frequency 2 per season Regressed Volume is 1,640 Duration Bound is 7				Qp: 4,550 cfs with Average Frequency 2 per season Regressed Volume is 31,100 Duration Bound is 16				Qp: 2,560 cfs with Average Frequency 2 per season Regressed Volume is 17,000 Duration Bound is 15			
	HFP 2					Qp: 2,480 cfs with Average Frequency 3 per season Regressed Volume is 15,700 Duration Bound is 13				Qp: 580 cfs with Average Frequency 3 per season Regressed Volume is 7,050 Duration Bound is 11			
	HFP 1					Qp: 1,260 cfs with Average Frequency 4 per season Regressed Volume is 7,280 Duration Bound is 10				Qp: 580 cfs with Average Frequency 4 per season Regressed Volume is 3,140 Duration Bound is 8			
Base Flows (cfs)	**Wet**	120				100				95			
	Avg	73				60				46			
	Dry	36				29				16			
Subsistence Flows (cfs)		1				1				1			

Flow Levels	**High (75th %ile)**
	Medium (50th %ile)
	Low (25th %ile)

Notes:

1. Period of Record used : 1/1/1939 to 12/31/2010
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 115 cfs, or when the flow is below 388 cfs and the flow drops from one day to the next by less than 5%.


Water Availability in the Lower Basin (Richmond)
Unappropriated Flow as a Percentage of Regulated Flow
Base_WAM Run 3
BBEST Recommendation
Recommended to BBASC
Unappropriated Flow as a Percentage of Regulated Flow
Percent of Time
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%